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# On Imputing for Financial Services in the National Accounts: Commercial Banking in General Equilibrium

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# On Imputing for Financial Services in the National Accounts: Commercial Banking in General Equilibrium

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## Abstract

We combine the income and capital accounts of financial intermediaries (commercial banks) and of non-financial firms and households to obtain a full accounting of the value of services provided by commercial banks to both depositors and borrowers. We track the payments for such services and find no missing items that need to be imputed for. So-called imputation turns out to be **integration** of the accounts of financial institutions with their borrowers and depositors. We also find that a large fraction of banking services are purely intermediate and thus that the net value-added, after integration, of the commercial banking sector in the total value-added of the economy is small. We also isolate terms that should be in the national accounts to represent the burden of risk-bearing by equity holders (an entry for apparent profits of firms). Deposits as a stock of money in our economy is analyzed.

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## 1. Introduction

The imputation for financial services provided by financial institutions (FISIM<sup>1</sup>) is the second largest in the national accounts of the United States, amounting to 1.7 percent of GNP in 1986 (Eisner [1989; p. 12]). Here we present a formal treatment of this imputation in a simple stationary general equilibrium model. We argue that the so-called imputation is really an **integration** of the accounts of financial and non-financial institutions. There are no missing items to impute for<sup>2</sup>. However, there are subtleties involved in carrying out the integration and we exploit a seemingly novel approach to national accounting practice. We proceed by integrating basic relations in the financial accounts of the firm with the traditional income-expenditure relations of the firm. The firm's capital constraint (equity equals book value minus debt) plays an essential role in our analysis. This is true both for financial firms as well as those producing non-financial products. The firm's capital constraint allows one to "translate" equity and debt costs to the firm, appearing naturally in its flow accounts, into terms for value-added in the national accounts. And in the "translation", certain terms involving the opportunity cost of funds turn out to play an essential role in the integration of financial activity with non-financial activity in the national accounts.

In conformity with conventional wisdom, we observe that, after the integration is done, much of the value-added associated with financial institutions ("banks" in our abstract model) is intermediate or appears in the market prices of goods produced in the non-financial sector of the economy. Residual value-added associated with banks appears in the household sector. We also observe that much of the value traditionally imputed for deposit services is in fact for banking services

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<sup>1</sup>FISIM stands for "financial intermediation services indirectly measured". For a modern discussion, see Inter-Secretariat Working Group on National Accounts [1993; pp. 563-568]. This group sets the rules for accepted practice in national accounting and has, of course, endorsed the idea of imputing for financial services.

<sup>2</sup>For the case of owner-occupied housing, an imputation is necessary – for the implicit flow of housing services produced and for the implicit expenditures for these flows made by the household. Implicit income to the household from housing capital must also be imputed for. See Hartwick [1997] for a treatment of this matter using the basic model used here. With regard to the services of banks, we do observe household income exceeding observable expenditures by exactly the value of deposit services from banks, consumed by the household. To complete the accounts, one then makes an imputation or balance entry in the household accounts. This is quite different from the imputations currently made for the services of banks. In particular current practice has an imputation for expenditures on deposit services of banks by every depositor, including all firms (our generic widget producers).

associated with loan-placing, not deposit servicing. (This heterodox view has been about for many years (eg. United States Department of Commerce [1954; p. 47]).) Our analysis "ends" with entries representing shareholder risk-bearing in value-added on the product side of the national accounts. This implies that there should be positive entries for "profits" of firms in the accounts. There is a basic methodological issue involved with having terms representing risk-bearing in the accounts. There is the implication that the financial or flow of funds view of national income is not perfectly separable from the view that real flows, on their own, comprise national income. The presence of our risk terms implies that the real and financial representations of national income are not independent. Also marginal cost pricing of inputs under constant returns to scale in the technology of production breaks down. The risk terms constitute wedges impeding the working out of marginal cost pricing. We also shed light on accounting for the cost of reserves held by banks for servicing depositors, and on the nature of deposits as a source of "cheap" funds for banks for lending.

Since integration of the accounts of financial and non-financial firms results in the substantial value-added of financial firms appearing "downstream" in the accounts of the firms doing the borrowing and deposit-placing, one might ask: "Why not leave the sectors unintegrated?" A strategy of non-integration would involve **netting out** from the observed prices for the goods and services produced by borrowers and depositors a value for services received from banks. Hence non-integration would, in practice, turn out to be considerably more complicated than simply leaving the value of banking services embodied in the prices of the outputs of firms which borrow and make deposits. In other words, the services of banks appear to reside most naturally in the national accounts as intermediate or as integrated "downstream" in the accounts of the borrowers and depositors. Market prices of products in the non-financial sector reflect the natural intermediateness of the services of commercial banks and the national accountant's task is (a) to determine how much of a good's market price reflects these banking services and (b) to determine how much value-added in the economy can be ascribed to the activity of commercial banks and (c) to determine how much of banking's value-added is reflected in expenditures by households.

The idea for imputing for deposit services goes back at least to the 1930s and seems to have its origins in the debates in the United States over the appropriate model for the national accounts<sup>3</sup>. The idea behind the argument for imputing is

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<sup>3</sup>See for example the exchange between Copeland and Kuznets (pp. 24-25, 35-37, 49-50) in National Bureau of Economic Research [1937]. References to earlier work (W.I. King and S.

that depositors sacrifice considerable potential interest income by accepting low deposit (interest) rates for their funds deposited in banks. Hence they must be getting services from the banks which are not appearing either in the revenue streams of banks or in the expenditure flows of depositors. Hence \$x is imputed to the revenues of banks for such services. x is set equal to bank revenue corresponding to the interest gap in the bank between the lending rate and the deposit rate. Actual bank interest **income** is moved to the expenditure side of the accounts, "netted" with interest outflow, creating a new entry of \$x of expenditures by the banks for "producing" deposit (and possibly additional financial) services worth \$x.<sup>4</sup> This \$x is then represented as **income for non-financial firms** which supply inputs to the banks for producing the deposit services. And the \$x gets assigned (imputed) to the expenditures of the non-financial firms, *qua* depositors, for deposit services. (Households also end up spending some funds for deposit services and get income assigned to them, also.) The bottom line is an imputation in the national accounts for banks (financial intermediaries) producing implicit deposit services to depositors. Our analysis below indicates that the original imputation is not necessary. All implicit deposit services are produced at cost and are fully paid for by depositors. The intuition about implicit deposit services being received by depositors is completely correct but the inference that banks accounts fail to register either a revenue stream for such services or an expenditure for inputs for producing such services is wrong. And payment for such services is fully embodied "downstream" in the disbursements by depositors. And they have

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Kuznets) are made but formal citations are not present. In the 1947 NBER volume, based on a conference of 1945, details of imputation for services to depositors are presented in Yntema [1947; pp. 35-43]. Ruggles and Ruggles [1956; pp. 60-64] presents a textbook treatment of the imputing for deposit services provided by financial institutions. ( In the first edition of this book (Ruggles [1949; pp. 56-61]) **gross** interest and dividend receipts of the bank are selected as the level of service flows to impute for whereas in the revision (Ruggles and Ruggles [1956]) the same numerical example is used but **net** interest and dividend receipts is the value of the imputation. We support this change but find the inclusion of dividend flows in the choice of the level of imputation to be novel. The reader will also be confused by the presence of the \$1 of imputed interest "downstream" in the accounts of the non-financial firm (depositor). In each edition there is the suggestion of exasperation in the phrase: "The attention given to the problem (of imputing for financial services) is out of proportion to its importance in the gross national product,...". ) There are no references in Yntema or Ruggles [1949], or Ruggles and Ruggles to earlier work on this imputation.

<sup>4</sup>This approach can lead to a bank having a negative value for **total** current expenses (see United States Department of Commerce [1954; p. 47]). The imputation procedure clears this anomaly up.

the requisite incomes for making the disbursements for the implicit consumption of such deposit services. **There is no need for introducing terms for missing items, particularly a term for the "consumption" of deposit services by depositors in banks, be they households or firms.** All terms are in fact represented in the market place and they need merely be processed correctly in order to obtain a valid figure for value-added<sup>5</sup>. The processing, we refer to as the **integration** of the accounts of the firms in the financial sector with those in the non-financial sector (including households).

The model we make use of below is uncomplicated and essentially static (stationary). Matters become transparent when we make use of the key fact that households are holders of equity in banks as well as in non-financial firms. Equity, in a stationary environment, equals a firm's book value, net of debt, and we make essential use of this identity in our presentation of a firm's adjusted income constraint (zero profit condition). The accounting entity at the center of a bank's accounts is the net income to the bank as represented by the gross dollar value of the spread between "the" lending rate and "the" rate paid on deposits<sup>6</sup>. In simplified cases, this dollar value of the spread does correspond with the total value of primary inputs used by a commercial bank in providing for its lending activity (to borrowers) and its transactions activity (to depositors) and so does capture the commercial bank's value-added in these simplified cases. We do not take issue with this line of thinking. It is in some sense the centerpiece of our analysis. The opportunity cost of funds (the textbook "certain" rate) plays a central role in our analysis<sup>7</sup>.

We make use of a host of simplifications or abstractions. Income volatility facing shareholders will not be explicitly modelled. We will leave government out of the analysis. There will be no taxes, public goods, or unusual government regulations such as legal reserve requirements for deposits. There is no money in

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<sup>5</sup>With regard to households, total income will be in excess of total observed expenditure by the value of deposit services consumed by households. An imputation is necessary here for services consumed but not for income needed to purchase the services.

<sup>6</sup>We use quotation marks here because there are in reality vectors of lending rates in effect (one for consumer loans, collateralized business loans, mortgage loans, etc.) and a vector of deposit rates (one for checking accounts, one for saving accounts, etc.). We are glossing over these distinctions and speaking of a single lending rate and a single deposit rate. This is standard in this sort of analysis (eg. Fixler and Zieschang [1991]).

<sup>7</sup>A real-world proxy for this rate would be the government's short term treasury bill rate. We "tested" this idea with Canadian data in Hartwick [1996].

our economy aside from demand deposits<sup>8</sup> and there is no central bank. There are only demand deposits (no savings or term deposits) and a single type of loan, made by commercial banks to firms, not households. Banks do not lend to each other. There is no deposit insurance and there are no service charges<sup>9</sup>. Each commercial bank does both deposit-taking and lending under one roof. We do not consider "narrow" banking, i.e. banking with separate deposit-taking and lending institutions (firms)<sup>10</sup>. The environment, at first, will be stationary with no depreciation of capital, no investment or technical progress and no growth or shrinkage in the activity of any firm or household. There will be no intermediate goods. We will present our central results and then make our model more realistic by adding new elements. For example, we have no reserves held by our abstract banks at first. We consider such reserves later. The addition of some key behavioral relationships toward the end leads to refinements in the measure of the marginal cost of funds. And we take up investment and depreciation, briefly. We do not take up capital gains. Finally we report on balance in the circular flow of payments (check-writing) and the production of check-writing services. Checks constitute "currency" in our model. All non-financial firms will be viewed as identical for accounting purposes. Similarly for commercial banks and households. There will be only three types of economic entities to deal with: commercial banks, non-financial firms, and households.

## 2. Firms (Non-financial)

A firm's wealth or capital "constraint" has equity equal to book value minus its debt value:

$$E = qK - (\eta Q_l - \beta \eta Q_d) \quad (2.1)$$

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<sup>8</sup>The possession of a demand deposit of  $y$  dollars entitles its owner to write checks in the accounting period for a total of  $y$  dollars. Check processing takes capital and labor; it is costly to the bank. The bank's check processing capacity in the accounting period is also linked one to one with its stock of demand deposits. The moneyness of demand deposits is related to the bank's cost of processing checks and the volume of demand deposits in a bank is constrained by the bank's capacity to deliver deposit services (check-writing capacity). More on this below.

<sup>9</sup>There turn out to be actual payments made to the banks by depositors for check-writing and payments made by borrowers for lending services from the banks. These are different from the explicit service charges we associate with realworld check-writing, for example. This will become clear below.

<sup>10</sup>The so-called narrow banking "form" is taken up in Hartwick [1996].

where  $q$  is the price of capital goods,  $K$  is machine and building capital (we ignore site values),  $\eta Q_l$  is the firm's debt in dollars and  $\beta\eta Q_d$  are deposits, in dollars, held by the firm in the commercial banks<sup>11</sup>.  $(1 - \beta)$  of deposits will be held by households. There are important matters of dimension-ness to keep track of.  $Q_d$  is a **number** of checks processed per year (per accounting period)<sup>12</sup>. Each check is for  $\eta$  dollars<sup>13</sup>. Hence  $\eta Q_d$  is the dollar value of checks processed per year. A  $\eta$  dollar check clearing involves  $\eta$  dollars of deposits having been deposited in the bank by the check-writer. Hence corresponding to  $\eta Q_d$  dollars of checks clearing (a flow) is a stock of  $\eta Q_d$  of deposits. Stocks are integrals of flows and here the accounting period is the interval over which integration is being carried out. Hence the flow value  $\eta Q_d$  is the same as the stock of deposits. Analogously,  $Q_l$  is the **number** of loans let out and monitored over the accounting period. We will assume that all loans are turned over each accounting period<sup>14</sup>. Each loan is for  $\eta$  dollars. Hence  $\eta Q_l$  is the dollar value of loans outstanding per year. One can associate a stock with  $\eta Q_l$  also<sup>15</sup>. In (2.1),  $E$ ,  $\eta Q_d$ ,  $\eta Q_l$ , and  $K$  are stocks.

Equity  $E$  is owned by households and all debt is owed to the commercial banks.  $(\eta Q_l - \beta\eta Q_d)$  is of course the net debt of the firm. The textbook rendering of this is that the firm's discounted profit, gross of debt payments, is  $V$  dollars. This value, net of the capital value of debt, is what shareholders would get in the event of liquidation. Hence the above "constraint": equity is book value less the value

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<sup>11</sup> $\beta$  will be endogenous near the end when we consider balance between payments and deposit levels.

<sup>12</sup>There is a production function involving capital and labor being used to produce check-clearing services. There is also a production function involving capital and labor being used to produce loan-placing services. The services of a certain amount of capital (buildings and machines) and of labor can process a certain number of checks per period. Similarly the services of a certain amount of capital (buildings and machines) and labor can process a certain number of successful loans per period. See the appendix. In each case financial capital is involved. To write checks, the person writing needs deposits. And to place loans, the bank needs funds to let out. There is a clean separation between the cost of writing a check and the payment flow associated with the check. Similarly, there is a clean separation between the cost to the bank of placing a loan and the funds loaned out for a particular lending.

<sup>13</sup>This solves an important units problem.  $\eta$  is a parameter and it could be set at \$1.

<sup>14</sup>An alternative view is that in the stationary state,  $Q_l$  of loans is let out in perpetuity and the cost each period is of monitoring the loans and of collecting the interest due.

<sup>15</sup>We are not being pedantic about stocks, flows, physical units, and dollar units. Deposit servicing and loan-placing involve the use of **physical** inputs, via a production function, **as well as** financial inputs. Confusion on the details of these matters results in much "talk", seemingly at cross purposes. We are attempting to be very explicit about the details of our models of the non-financial firm, the commercial bank, and the household.



of debt owing. Another way of reading this "constraint" is: the value of paper claims on the firm (namely  $E + (\eta Q_l - \beta \eta Q_d)$ ) must equal the dollar auction value (equal to the value of inputs) of the firm.

The firm's income constraint (revenue equals expenditure for inputs<sup>16</sup>) is:

$$pX - wN - r_l \eta Q_l + r_d \beta \eta Q_d - (r + \gamma)E = 0, \quad (2.2)$$

where  $pX$  is the value of sales (total revenue),  $wN$  is labor cost,  $r_l \eta Q_l$  is debt payment ( $r_l$  is the loan rate), and  $r_d \beta \eta Q_d$  is interest received on deposits.  $(r + \gamma)$  is the rate paid for a dollar of equity.  $r$  is the "certain" rate and  $\gamma$  is the risk premium "demanded" by a shareholder as compensation for receiving an income stream with some volatility associated with it<sup>17</sup>. The mean of the income stream is stationary and equal in aggregate to  $rE$  dollars.

We now multiply the capital constraint in (2.1) by  $r$ . This allows us to express the income stream  $rE$  as  $r q K - (r \eta Q_l - r \eta Q_d)$ . So we substitute for  $rE$  in the income constraint in (2.2) to get

$$pX - (r_l - r) \eta Q_l - (r - r_d) \beta \eta Q_d - \gamma E = wN + r q K. \quad (2.3)$$

The right hand side is value-added as expressed by the value of primary **inputs**. The left hand side is then an expression for value-added in terms of the net value of production or **output** of the firm. Observe that  $\gamma E$  is an entry representing the payment to equity holders for risk-bearing.  $(r - r_d) \beta \eta Q_d$  is literally a payment by the firm to the bank for the "privilege" of writing checks on its deposit account. It is a "service charge"<sup>18</sup> levied by the bank for check-writing. The firm is writing  $\beta \eta Q_d$  dollars worth of checks in the accounting period. Analogously,  $(r_l - r) \eta Q_l$  is a "service charge" for borrowing bundled into the firm's

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<sup>16</sup>This zero profit constraint can be interpreted as resulting from the competitiveness of production (many firms small relative to the size of the market and free entry). We will treat our firms as operating under constant returns to scale. There is a production function  $f(\cdot)$  linking inputs  $K$  and  $N$  to output  $X$ . See the appendix. This leaves open the question of firm size. Such vexing matters are well known and we make no innovations to get around them.

<sup>17</sup>The  $\gamma$ 's are treated as reduced form terms. In a full blown model they would embody tastes for risk aversion by agents and the variance-covariance structure of equity returns in the economy.

<sup>18</sup>The term service charge here is appropriate because it is a charge for a service. But these services charges are implicit to the firm. Thus the loan service charge is bundled into the firm's payments on the loan and the check-writing service charge is implicit in the low rate paid by the bank on deposits. These service charges show up below as inflows to the banks. In the integration-of-accounts step, the entries offset each other, yielding the **net** value-added in the economy.

payments for a loan. The amount borrowed is of course  $\eta Q_l$  dollars. With the exception of the term  $\gamma E$  in (2.3), the "move" from (2.2) to (2.3) involves purging the firm's income-expenditure constraint of financial (interest payment) flows and re-expressing the firm's income-expenditure constraint in "real" flows. That is, on the left in (2.3),  $pX$  is income in dollars for the sale of **produced** widgets,  $(r_l - r)\eta Q_l$  is expenditure for **services** provided by the bank associated with the firm's borrowing of  $\eta Q_l$  dollars, and  $(r - r_d)\eta Q_d$  is the expenditure by the firm for deposit **services** (check-writing) for  $\eta Q_d$  dollars of deposits.  $\gamma E$  is a payment for risk-bearing and is what we refer to as a financial flow as distinct from a "real" flow.

Under current national accounting practice, a term representing payment for deposit services, analogous to our  $(r - r_d)\eta Q_d$ , is inserted into (2.2) as expenditure. This is an **imputation** for a purported missing term. A corresponding amount of income is placed in these firms' accounts to represent the payment by the banks for inputs purchased from the firms so that the banks can produce services. The bank is now said to be receiving revenue from the non-financial firms for supplying deposit services to the firm. This revenue inflow to banks corresponds to the "original" basic imputation. We see below that the banks outputs already include the relevant terms. No imputation is necessary. And  $pX$  already embodies this term, as (2.3) makes clear.  $pX$  is the same value in (2.3) and (2.2). How did we obtain the correct entries in the accounts without imputing or inserting them from "outside"? Simply by making use of the firm's capital constraint, (2.1), in its income-expenditure constraint. This seems to be a new line of procedure in national accounting.

To avoid clutter (dragging  $\Sigma$ s around), we will adopt the following notational convention: values for our representative firm above will be used without summation signs or other indicators for all non-financial firms, summed together. Thus  $pX$  is the revenue of all non-financial firms,  $\eta Q_l$  is the debt owed to the banks by all non-financial firms, etc. We will proceed in the same way with a representative bank and all banks and with a representative household and all households. It is as if there is one **competitive** bank, one **competitive** widget producer, and one household selling its labor services **competitively**.

### 3. Accounts for the Commercial Banks

One novelty of the commercial bank as a firm is that its debt, the difference between the capital values of its deposits,  $\eta Q_d$ , and of its loans,  $\eta Q_l$ , will be

**negative** in a "normal" bank<sup>19</sup>. More on this below. Its capital constraint is:

$$E^b + (\eta Q_d - \eta Q_l) = qK^b. \quad (3.1)$$

Superscript b denotes, bank. Since  $qK^b$  is positive, equity  $E^b$  must exceed  $(\eta Q_l - \eta Q_d)$ . These considerations suggest writing (3.1) as

$$E_R^b + (\eta Q_d + E_l^b - \eta Q_l) = qK^b$$

where  $(.)$  is zero and  $E^b = E_R^b + E_l^b$ .  $E_l^b$  is then that part of shareholder equity which ends up as loans. Subscript R denotes, "residual" equity. This means that shareholders are actually supplying capital to the lending process<sup>20</sup>. This is a convention which signals a commitment by the owners of the bank to its depositors. The owners (shareholders) of the bank are shouldering a risk of capital loss should the loan portfolio incur a meltdown in value. Depositors need some commitment that lending will be prudent so that their risk of capital loss is small. Prudence is supposed to be signalled by owners by the presence of their own capital in the bank's loan portfolio. Deposit insurance has, of course, been introduced to close the risk gap that a depositor might experience if she were obliged to rely solely on the prudence of loan officers, as agents of shareholders, as principals. We leave deposit insurance out to avoid clutter. (It clearly plays a central role in the way a real-world bank operates<sup>21</sup>.) We also abstract from losses which a bank regularly budgets for and from the presence of reserves, necessary to maintain flows of cash to depositors. From a monetary theory standpoint, deposits are the only money in our economy.

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<sup>19</sup>We hear the echoes here of the negative interest flow associated with the classic imputation argument but it is best to ignore these muted sounds. We are stating that in terms of **the stocks of loans and of deposits**, banks are net lenders, not borrowers. This is a reasonable definition of a bank.

<sup>20</sup>The fact that part of equity finance flows out as loans implies that the marginal cost to the bank of another dollar of capital for lending is the cost of another dollar of equity, namely  $r+\gamma$ . This yields the implicit price which the bank assigns to renting a dollar of deposit capital from the deposit side of the bank for the lending activity on the lending side of the bank. More on this later.

<sup>21</sup>Deposit insurance isolates, to a large extent, the depositors from the riskiness of the bank's loan portfolio. This makes the owner's equity stake an unnecessary signal of commitment to prudence on the part of the bank's owners. It is widely contended that a bank's lending strategy is less prudent when deposit insurance is ubiquitous. In an era of widespread deposit insurance, it is government regulators who demand an equity stake of people supervising the loan officers in a bank.

The bank's income statement is (from zero profits<sup>22</sup>):

$$r_l \eta Q_l - r_d \eta Q_d - w N^b - (r + \gamma^b) E^b = 0 \quad (3.2)$$

If one multiplies (3.1) by  $r$ , one gets an expression for income stream  $rE^b$ , namely  $r q K^b - (r \eta Q_d - r \eta Q_l)$ . We substitute this for  $rE^b$  in (3.2), to get

$$(r_l - r) \eta Q_l + (r - r_d) \eta Q_d - \gamma^b E^b = w N^b + r q K^b. \quad (3.3)$$

The right hand side is value-added as expressed by the value of primary **inputs**. The left hand side is the value of bank **output**<sup>23</sup>. The outputs of the bank comprise check-clearing services for depositors, valued at  $(r - r_d) \eta Q_d$  dollars, and loan-placing services for borrowers, valued at  $(r_l - r) \eta Q_d$  dollars.

These terms have a straightforward interpretation in terms of opportunity costs. Since  $r$  is the rate depositors could get if they put their funds in safe securities,  $(r - r_d) \eta Q_d$  must be the implicit flow of services which depositors get when they choose to put their funds in commercial bank deposits. They get the lower rate  $r_d$  and so must be getting an implicit service flow  $(r - r_d)$  per dollar<sup>24</sup> placed as deposits. This service flow we identify as "transactions" services; services related to check-writing privileges. We are now abstracting from services associated with cash balance safe-keeping and record-keeping<sup>25</sup>. An analogous

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<sup>22</sup>We again assume constant returns to scale and free entry. There is implicit here a two product, two input production function,  $g(Q_l, Q_d, K^b, N^b) = 0$ . See the appendix for some analysis of this. The issue of non-constant returns to scale in commercial banking has frequently been addressed. See for example Berger and Humphrey [1992] for some recent econometric work. Our bank is producing a number of standard **loans** and of a quantity of **deposit services** *per se*. Quantity  $Q_l$  of loans placed, each of \$1, corresponds to  $\$Q_l$  of loans placed in the accounting period. Also,  $Q_d$  of checks processed in the accounting period, each check for \$1, corresponds to  $\$Q_d$  of checks cleared. This flow of money corresponds to money  $M$  times velocity  $v$ . Velocity  $v$  is unity here, so the stock of money is  $\$Q_d$ . Since to write a check, one must have a dollar of deposits, the stock of money here is the stock of deposits, namely  $\$Q_d$ .

<sup>23</sup>In Hartwick [1996] I used the 90 day Government of Canada treasury bill rate for  $r$  and proceeded to represent aggregate commercial bank income  $r_l \eta Q_l - r_d \eta Q_d$  as  $(r_l - r) \eta Q_l + (r - r_d) \eta Q_d$  where  $r_l, r_d, \eta Q_l$ , and  $\eta Q_d$  were vectors since the banks have baskets of diverse loans and deposits.

<sup>24</sup>Hancock [1985] and others refer to such interest rate spreads as "user costs", a term favored by Keynes for denoting asset prices. Hancock and others have focussed on **estimating** an average value for our certain rate  $r$ . Clearly one is very interested in a measure of the opportunity cost of funds in the economy. We suggest that the short term treasury bill rate is a reasonable proxy for this elusive opportunity cost of funds.

<sup>25</sup>The long-standing question of whether deposits are inputs or outputs of a bank is "reviewed"

opportunity cost interpretation should be attached to the term,  $(r_l - r)\eta Q_l$ . The bank could lend out its funds and get the certain rate  $r$  but chooses to place them with other borrowers and get the higher rate  $r_l$ . Thus  $(r_l - r)$  is the surplus it anticipates on a dollar lent out. This surplus will be driven down to the cost of lending the marginal dollar by competition for "surplus" among commercial banks, *qua* lenders. Hence  $(r_l - r)\eta Q_l$  measures the cost of loan provision by the commercial banks. And from the perspective of demanders of loans,  $r_l\eta Q_l$  is willingness to pay for loans. Since  $r\eta Q_l$  is the financial cost of the loans,  $(r_l - r)\eta Q_l$  must represent the "service" value demanders receive in getting loans. This is the value of intermediation services which the commercial banks provide - the services associated with assembling funds, scrutinizing the borrowers and their projects, and lending the funds out to the diverse borrowers. The remaining term on the left in (3.3) is the cost to the bank of compensating shareholders for liquidity risk. What we have done in (3.3) is to provide an economically defensible way to break the aggregate value of primary inputs in a commercial bank into components - one corresponding to transactions activity and one to intermediation or lending activity. There remains the entry corresponding to the cost of shareholder risk.

#### 4. Commercial Banking in Aggregate Value-added

When one integrates or fits together the value of activity by commercial banks and of non-financial firms (by summing the respective right and left hand sides of (2.3) and (3.3)<sup>26</sup>), one obtains:

$$\begin{aligned} & pX + (1 - \beta)(r - r_d)\eta Q_d - \gamma E - \gamma^b E^b \\ = & wN + wN^b + rqK + rqK^b. \end{aligned} \quad (4.1)$$

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in Triplett [1992]. Much of deposit capital constitutes funds for lending and in this sense deposits are inputs to a bank's lending activity. The claim which a depositor has on a bank's demand deposits "translates" into check-writing privileges. In a clear sense, a depositor derives a stream of benefits from having her capital in a bank deposit. Thus the banks is supplying services to depositors. It is producing an output, an output specifically linked to the volume of deposits. Put somewhat more succinctly, demand deposits are here, the stock of the money and money, when flowing, is useful for transacting.

<sup>26</sup>One might interpret this summing operation as the transferring of part of bank interest income back to firms *qua* depositors and borrowers. The interest income then cancels with the expenditures being made for borrowing and for the receipt of transactions services (check-writing services), by the non-financial firms.

The right hand side is total value-added in the economy as represented by the value of all primary inputs. The left hand side is total value-added, represented by the net value of outputs, net of the compensation to shareholders for risk-bearing. The two values of output are  $pX$ , outputs of the non-financial firms, and  $(1 - \beta)(r - r_d)Q_d$ , transactions services provided by the commercial banks **to households**<sup>27</sup>. If  $\beta$  is near unity, which it would be if firms were heavier "consumers" of deposit services (check-writing) than households, then the entry for bank services in (4.1) will be very small. This is a statement of our observation in the Introduction that the **net** value-added ascribable to commercial banking in total value-added in the economy will be relatively small<sup>28</sup>. Only a fraction of commercial bank output on the left hand side in (3.3) ends up as a distinct entity in total value-added in the economy. Most of bank value-added is embodied in the price of the output of the non-financial firms. All of the intermediation services (lending activities) provided by the bank end up "naturally" (via the price system) in the value of the outputs of the borrowing entities. Also much of the transactions services provided by commercial banks also end up "naturally" in the value of the outputs of the non-financial firms. See (2.3). Integration makes clear how the bank's value-added resides most naturally in the statement of the value-added of the non-financial firms.

A second result, appearing in (4.1), is that the sum of the market values of outputs in the economy should exceed the sum of the values of primary inputs. The wedges are the costs of risk-bearing by shareholders (namely  $\gamma E + \gamma^b E^b$ ) embodied in the market prices of outputs. Such entries are often identified as profits going to the owners of firms. We have above a precise statement that the costs of risk-bearing by shareholders have a natural entry in the national accounts. These entries have appeared in a natural way because we have integrated some fundamental relations in financial accounting into the basic relations of national accounting.

This ends our basic analysis of so-called imputing for deposit services in the national accounts. We have sorted out where value-added resides and what its magnitude is. We have sorted out flows of loan-placing services and flows of deposit services. Banks are the producers and non-financial firms are the "con-

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<sup>27</sup>These deposit services consumed by households will be accounted for in the incomes of households but will be implicit in the expenditures of households. Hence an imputation here is necessary. This is quite different from the standard imputation procedures in current practice.

<sup>28</sup>When we consider the circular flow of payments, the argument will be made that  $\beta$  in our model should be  $1/2$ .

sumers". Payments and receipts have been isolated. New terms representing the costs to the firm of paying equity holders for risk have been isolated. We turn next to completing the accounts by incorporating the household sector, the consumer of final product and the receiver of all "final" income. This is quite routine. Then we turn to some refining of the basic model, as in the incorporation of reserves held by banks for "administering" deposits. The large accounting matters being dealt with in this paper will end with the next section. We move beyond to the matter of how our basic model functions as an economic system, including the question of the circular flow of payments through the deposit accounts as flows of dollars inscribed on checks.

## 5. Household Income and Capital Accounts

The accounts circle is complete when we observe that household income, derived from the sale of labor and the ownership of equities and deposits, equals household expenditure, comprising the value of check-writing services from commercial banks and the output, widgets, of non-financial firms (namely  $pX + (1 - \beta)(r - r_d)\eta Q_d$ ). We consider first the capital "constraint" for the household.

The only "loans" our households have is their demand deposits. They do hold all the equity in firms, including banks. We have then the household capital "constraint":

$$E + E^b + (1 - \beta)\eta Q_d = qK + qK^b \quad (5.1)$$

The paper claims, possessed by the household, equal the value of capital in the economy. Households also rent out their labor services, but that is a flow, as distinct from a capital, process. Note that households both own the banks in their role as shareholders and are creditors to the banks, in their role as depositors. Any claim that a bank has on a firm with a loan, is really a claim held by households since they own the banks via their shareholdings. Households end up as the ultimate extenders of credit because all of their deposits<sup>29</sup> and some of their equity in the banks constitutes the total of funds lent by the banks.

The household income constraint has income equal to expenditure:

$$wN + wN^b + (r + \gamma)E + (r + \gamma^b)E^b + (1 - \beta)r_d\eta Q_d = pX.$$

One item in vector X might be housing services and the corresponding price

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<sup>29</sup>We take up reserve holding by banks below.

would be a rental payment. Our representative household has no debt<sup>30</sup>. If one multiplies the capital constraint by  $r$  and combines it with the income constraint, one has:

$$\begin{aligned} & wN + wN^b + \gamma E + \gamma^b E^b + rqK + rqK^b \\ = & pX + (1 - \beta)(r - r_d)\eta Q_d \end{aligned}$$

This relation is identical with that in (4.1). The circle of accounts is closed since the households end up as consumers of total product and as the ultimate recipients of all income flows. There is no value-added associated specifically with the household sector in our model.

## 6. Bank Reserves for Deposits

The reason for a bank to hold reserves of cash in proportion to deposits placed in the bank is to service customers who use cash. Since we have no cash (currency) in our model, there is no reason for a bank to hold reserves. Be that as it may, we proceed to analyze the incidence of the cost of reserve-holding by banks. The excursion has some curious twists. This is in part because our model is really a simple general equilibrium system. What happens with firms must work out in a mirror-symmetric way for the households. First, it is obvious that the bank must pay interest on the reserves held. The depositors are unaware that some particular deposits are held in the bank's vaults and others are lent out. Secondly, the bank must provide deposit services to depositors who own the deposits held as reserves. Hence it costs the bank at least  $k\eta Q_d$  (i.e.  $k(r-r_d)\eta Q_d + kr_d\eta Q_d$ ) for holding deposits, where  $k$  is the "reserve ratio". And the bank cannot lend out the  $k\eta Q_d$  of capital held as reserves. Hence there is no off-setting revenue stream. To formalize this, one **starts** with the observation that depositors' (as creditors to the bank) claim on the book value of the bank is smaller by the amount of capital tied up in the reserves used by the bank for deposit "administration". That is, with reserve ratio  $k$ , we have in place of (3.1),

$$E^b + ((1 - k)\eta Q_d - \eta Q_l) = qK^b.$$

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<sup>30</sup>A typical debt of the household is a mortgage on the house. Incorporating such home ownership arrangements involves imputations for services yielded by the house to the dwellers. We have investigated these imputations in Hartwick [1997].



Now when  $rE^b$  is inserted in the bank's income constraint, the new expense,  $rk\eta Q_d$ , appears for the bank. This is of course the cost, discussed above, of maintaining reserves for "administering" deposits.

We turn to the accounts of households and non-financial firms to locate the off-setting entry. First, the capital constraint for non-financial firms in (2.1) must have its  $\beta\eta Q_d$  changed to  $(1-k)\beta\eta Q_d$  and the capital constraint for households in (5.1) must have its  $(1-\beta)\eta Q_d$  changed to  $(1-k)(1-\beta)\eta Q_d$ . Given these adjustments, the intergration of the accounts of banks with those of the non-financial firms and households yields the same closure that we observed when we omitted reserves held by banks for deposit administration. The cost of reserve holding,  $rk\eta Q_d$ , in the flow accounts of the banks gets precisely offset by terms in the flow accounts of households and non-financial firms. However, the textbook rendering of costs of reserve-holding to banks, as interest foregone, is not really correct since banks will pass these costs on to their customers in some fashion. To see the full story readily, one simply has to combine terms in  $Q_d$  in the bank's flow accounts in (3.3). One obtains  $((1-k)r - r_d)\eta Q_d$ . This is indicating that the transactions services provided by the bank are reduced when reserves are maintained. And the flow accounts of households and non-financial firms reflects the lower service flow being received. The true cost of reserve-holding by banks is here, that depositors must hold larger amounts in deposits in order to effect the same dollar value of check-writing. Simply put, some fraction of deposits made by households and non-financial firms become inaccessible for the purposes of check-writing. Hence to perform the same volume of check-writing in dollars, more deposits must be placed in banks. The ultimate cost of reserve maintenance is fully passed on to depositors. This cost is not real in our model because deposit levels are set initially for households and non-financial firms, and any level can be attained. But in a model with cash balances held outside of banks, agents would be forced to reduce such balances at the margin in order to maintain marginally larger balances at the bank. This would constitute a real cost. Alternatively, higher total balances (summing cash and deposit balances) would be needed and agents would have to forego consumption in order to build up the needed larger stock. There would be real costs to incur in order for banks to maintain reserves for deposit administration.

## 7. Behavioral Relations and Marginal Conditions

Because an integrated commercial bank is obliged to raise some of its funds for lending **from shareholders**, as well as from depositors, the marginal cost of funds for lending, to the bank is  $r + \gamma^b$ , not the  $r$  we indicated above<sup>31</sup>. Hence a more accurate measure of the size of the bank's services associated with its lending activity is  $(r_l - (r + \gamma^b))\eta Q_l$  and of its transactions activity is  $((r + \gamma^b) - r_d)\eta Q_d$ . Since  $E_l^b$  was defined equal to  $\eta Q_l - \eta Q_d$  above, (3.3) can be written as:

$$(r_l - (r + \gamma^b))\eta Q_l + ((r + \gamma^b) - r_d)\eta Q_d - \gamma^b E_R^b = wN^b + rqK^b. \quad (7.1)$$

This provides a more accurate "formula" for decomposing the value of primary inputs used by the bank into the respective value of outputs of the bank<sup>32</sup>. We have, in passing, obtained a representation of the widely-held view that deposits are a "cheap" source of funds to the bank for lending. There is a correct sense in which the marginal cost of deposit funds to the bank is, to a first approximation,  $r$ , and of equity funds is  $r + \gamma^b$ . So at the margin the bank is induced to take on "extra" funds for lending from depositors, relative to those from shareholders. However the consequence of this tilting in favor of "cheap" deposit funds is to bring the marginal cost of a dollar for lending to the same value from either source, namely  $r + \gamma^b$ . This simply reflects cost minimization by the banking firm. The "cheapness" of deposit funds relative to funds from shareholders yields a marginal expansion in funds taken on from depositors relative to funds taken on from shareholders.

A recognition that the opportunity cost of funds for lending by the bank is in fact  $r + \gamma^b$  and not  $r$  leaves our central results above unchanged. That is, the summing of the respective sides of (2.3) and (7.1) also yields (4.1). The variables  $E_R^b$  and  $E_l^b$  now enter the solution of the model and the solution values of various variables will change, but not the key equation for value-added in the economy or for net value-added by the banks.

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<sup>31</sup>This matter of the cost of funds from depositors and/or equity holders was taken up in Hartwick [1996].

<sup>32</sup>This more accurate decomposition of banking services produced into loan-placing services and deposit services tilts the faction of total banking services produced somewhat in favor of deposit services relative to loan-placing services. Recall that early debates focused on whether all of the implicit bank service flow was for deposit services or whether some of the flow was for loan-placing services also. We have established that both service flows are contained in total service production by banks, but in this section we have presented an argument that suggests that deposit services may be quantitatively more important..

A second key behavioral relationship is the fact that, at the margin, when a non-financial firm takes on capital, it should be indifferent between raising a dollar as equity or as debt (part of a bank loan). This implies that premiums  $\gamma$  and  $\gamma^b$  must be linked in

$$\begin{aligned} r + \gamma^b + mc(Q_l) &= r^l \\ &= r + \gamma \end{aligned}$$

where  $mc(Q_l)$  is the marginal cost to the bank of preparing another dollar for lending.  $(r + \gamma^b)$  is "the cost of funds" of the marginal dollar which the bank is lending out. Again this important behavioral relation affects the quantitative aspects of our model but not our qualitative results for the purposes of national accounting<sup>33</sup>.

## 8. Investment by Firms

National accountants do not, of course, have the luxury of dealing with data from simple models. Prices and quantities change within and between accounting periods as tastes, technology, prices of imports and exports, etc. change. Here we will consider change arising from "growth" or from the savings and investment of households. One motivation for pressing into this departure from stationarity is to get a grasp of bank losses. We espouse the view that banks are special in the sense that their lending activity involves them in inevitable losses because some of the projects which they fund, fail<sup>34</sup>. Firms which specialize in lending budget for some failed loans, some capital write-down. Before considering this in detail, we will take up a simpler case of saving and investing in our model.

First, we will consider saving and investing by the household in the non-financial sector for the case of no depreciation and the level of investment as small. For large investments, the banking sector must expand in our model in order to accommodate the increased lending activity. We will assume that at the

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<sup>33</sup>The Modigliani-Miller Theorem says that the value of the firm is independent of its debt-equity ratio. This should not be confused with the assertion that its cost of funds for investment will depend on its leverage. The more leverage a firm displays, the higher will be the risk premium in the interest rate it pays on its bonds.

<sup>34</sup>Presumably every firm budgets for a loss on some of the product it produces. However, this would show up in the writing down of product in inventory which did not sell as planned. This is somewhat different from bank losses if only because inventory to a bank is capital for lending. There are loan write-downs but not inventory write-downs in banks.

margin the bank can handle our increased lending without itself expanding its capital,  $K^b$ . We have saving and investing occurring **at the end** of an accounting period. Household saving is the sum,  $dE^b + dE$ , equal to  $qdK$  of new capital for firms in the non-financial sector. The bank lends out the  $dE^b (= \eta dQ_l)$  to the expanding firms. The borrowing firms get funds from the banks and part from households as increased equity. We assume that the sizes of the  $dE^b$  and  $dE$  are such as to maintain equality in the cost of capital to the firms from its two possible sources.

So at the end of a period,  $qdK$  is removed from the pX of the households and  $dE^b + dE$  from their incomes. The capital accounts of the borrowing firms register increases,  $qdK$ ,  $dE$ , and  $\eta dQ_l$ . The capital accounts of the banks register increases  $\eta dQ_l$  and  $dE^b$ . All accounts remain in balance. Now we move to the beginning of the next period. In the next period the borrowing firms expand production and commence payments to the bank on their  $\eta dQ_l$  and to the households on their  $dE$ . The rates are of course  $r_l$ , the same as in the earlier period, and  $r + \gamma$  on the equity. The borrowers are in a new zero profit position. The banks use the  $r_l \eta dQ_l$  to pay the equity holders  $(r + \gamma^b) dE^b$ . The banks are in a new zero profit position. And households use their extra income, namely  $(r + \gamma^b) dE^b + (r + \gamma) dE$ , to purchase the extra production of the non-financial firms. Household income equals expenditure. We have in fact "forced" the flow accounts to move into balance in the new period. A more detailed analysis of how output expands in firms doing the investment is required to assure that in fact flow balance is achieved in the "new" period. And we assumed that banks could expand lending without themselves investing in more "capacity". We are in a sense doing comparative statics and comparative equilibria analysis simultaneously. Some small amount of *ad hoc*ery is inherent. The careful reader can see where the ends of the analysis are loose.

Consider now the case of some investment ending up in projects which fail. The household saves  $dE^b + dE$  at the end of a period, equal in value to  $qdK$  drawn from product pX. Now only  $(1 - \delta) dK$  ends up in successful projects so in the next period the expansion in X is smaller. Banks lend  $dE^b (= \eta dQ_l)$  but receive interest flow  $(1 - \delta) r_l \eta dQ_l$  in the next period. We will assume that the failing projects fail instantly. Banks raise their loan rate somewhat and register a capital loss  $(1 - \delta) \eta dQ_l$  in their income-expenditure account. They pay the new shareholders their  $(r + \gamma^b) dE^b$ . We assume that the bank is in a new zero profit equilibrium. It has a higher loan rate and a loan write-off in its flow accounts. The borrowing firms with successful projects end up paying a higher loan rate on the  $(1 - \delta) \eta dQ_l$  which they "translated" into successful investment. For the

moment the successful firms pay the old rate on  $(1 - \delta)dE$  of new equity in the successful investments. Hence household income will be higher in the "new" period by  $(r + \gamma)(1 - \delta)dE + (r + \gamma^b)dE^b$  which we assume equals the value of new output from the successful firms. To move into a new stationary situation, the return to shareholders would have to rise to equal the new higher rate demanded of borrowers by banks. Our main point is that with failed projects, banks will register capital write-offs in their income accounts and will raise their equilibrium lending rate to accommodate the losses. Equilibrium lending-borrowing rates will reflect equilibrium rates of project failure.

## 9. The Circular Flow of Payments (Check-writing)

We return to our simple, early model, with a stationary economic environment. A simple approach to obtaining balance in the flow of payments (check-writing) and the production of check-writing services is to observe that households spend  $pX$  dollars and thus write  $pX$  dollars worth of checks in the accounting period and that households receive all the income, with checks written by firms to pay wages, interest on loans net of deposit interest, and shareholder equity. Consider equation (4.1). It can be written

$$pX + (1 - \beta)(r - r_d)\eta Q_d = (Net\ Income) + \beta(r - r_d)\eta Q_d. \quad (9.1)$$

Now  $(1 - \beta)\eta Q_d$  is the flow of deposits (checks) used by households to purchase the consumables,  $pX$ . And  $(1 - \beta)(r - r_d)\eta Q_d$  is the payment to the bank made by the household for drawing on its deposits. There is then a quantity theory relation being satisfied in equilibrium, namely:

$$(1 - \beta)\eta Q_d(1 - (r - r_d)) = pX. \quad (9.2)$$

On the right is the demand for money flows and on the left is the supply of money flows in the final goods sector. The left is the the analogue of  $Mv$  in  $Mv=pT$ , where  $M$  is the stock of money and  $v$  is velocity.  $p$  in  $pX$  is the price level or numeraire in our model.

On the right hand side of (9.1) we have the charges for check-writing, namely  $\beta(r - r_d)\eta Q_d$ , for checks written by the non-financial firms. These checks sum to flow  $\beta\eta Q_d$  for the accounting period. The checks are written to move payments from the firm to households for labor services and equity, and to the banks for loan services and deposit services. We will **assume** that the banks incur no check-writing costs in moving its incoming checks out to shareholders (households) and

to workers (households). Banks also incur no costs in paying deposit interest since such payments are factored into net payments going into the banks from households and non-financial firms. For the special case of  $\beta = 1/2$ , the volume of flows going into the households in the accounting period will equal the volume leaving to pay for pX. This follows from equations (9.1) and (9.2) and the assumption of  $\beta = 1/2$ . Thus households will end up with their (Net Income) equal to pX at the end of the accounting period and be in a position to purchase the new pX in the next period. For this stationary, cycling system to get started, the right level of deposits must be owned by households and firms at time zero. Once started, it remains in an equilibrium circular flow.

## 10. Concluding Remarks

In our simple, stationary economy total value-added comprises the value of widgets produced in firms in the non-financial sector, and a fraction of the total of services produced by the banks. This latter corresponds to deposit services "consumed" in the household sector. We also have terms or wedges, presumably small, representing the cost of risk-bearing by households, *qua* shareholders in the firms. Our accounting analysis has been performed by a "procedure" which allowed us to accurately separate value-added in commercial banking on the product side into its constituents. **There was no need for imputing or inserting terms. This differs from current practice**<sup>35</sup>. Our procedure made essential use of basic relations in financial accounting (our capital "constraints"). We considered refinements to our basic model, including changes occurring under positive saving by households and investment by non-financial firms. A trickier non-stationary environment would have capital gains and losses as say interest rates shifted through time.

A quite distinct add-on would be a government sector. Then taxes and government bonds would appear in diverse places. And we could contemplate monetary policy and possibly a central bank. The latter can be viewed, from a minimalist perspective, as an instrument for dampening volatility by acting as a provider of short term capital for commercial banks with short run liquidity problems. The larger role of the central bank is in creating money via open market operations.

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<sup>35</sup>We have emphasized that household incomes will exceed observable expenditures by an amount equal to the value of deposit services consumed by households. An imputation is necessary here and we emphasize again that this adjustment is quite different from those being made under current accounting practice.

These matters are well beyond our purview here. We did analyze how deposits became the stock of money in our economy once check-writing was linked to those deposits and check-writing was placed in balance with flows of payments in our simple economy.

The ease with which we have been able to construct a model with fairly intricate "monetary" and real dimensions appears to derive from four sources. The first two are standard. First, we have operated at a high level of aggregation. Our banks were all the same. Similarly for our households and our non-financial firms. Secondly, we restricted attention, for the most part, to stationary environments. The economics of one period was essentially the same as that of any other. Also stochasticity was left implicit. The two other reasons are: (1) we came at the subject from an economics-accounting perspective. Delicate behavioral questions were taken as solved. This economics-accounting perspective is not the one widely seen in textbooks in micro-economic theory<sup>36</sup>. And (2) the matter of money in our economy was not a central focus at the outset<sup>37</sup>. This allowed us to avoid the complexities of introducing money into (grafting money onto) say, an Arrow-Debreu model. Our flows of checks, linked one to one with deposit holdings, turned out to be a form of money that was easy to analyze. There was no need to keep track of currency and agents' cash balances. And issues associated with patterns of transactions, as in the co-incidence wants, were essentially assumed away. A possible use for a model like ours is in simulation analysis. One might start by making the rate of project failure,  $\delta$ , a random variable and examine the amount of induced variation in key variables over time. However, until results from such possible investigations turn out interesting, we should consider our paper to be

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<sup>36</sup>The economics-accounting perspective slights the analysis of how the data for accounting emerge, as in the analysis of optimization by agents. The approach takes the micro data largely as given and analyzes patterns which emerge when the units are aggregated. We do not want to argue that theory does not influence what data are collected. Theory does not, however, provide detailed maps of where to take the data, once in hand. The general problem of "imputing" for financial services could only have arisen in accounting but it involves interesting issues in microeconomic theory and we suggest the theory of money.

<sup>37</sup>Our point of departure was an analysis of the commercial bank as a firm. We were interested in the question of the inherent differences between the bank as a firm and the widget producer as a firm. If one ignores jointness in outputs from a bank and accepts that the outputs are intermediation **services** (loan placing) and transactions **services** (check-processing for depositors, in a narrow view), then the banking firm's flow accounts are generically the same as those for a non-financial firm. See our equations (3.3) and (2.3). Matters become interesting when one observes that the accounts of banks and non-financial firms fit together in such a way that most of outputs of banks should be viewed as intermediate.

principally a contribution to the theory of national accounting.



## 11. Appendix

Here we report some fundamental relations on technology and input accounting in our basic economy. We continue to assume that we can represent production in each of our two sectors by single firms, acting as price takers. There is constant returns to scale so the definition of a firm is awkward in any case. In the non-financial sector quantity  $X$  is produced and there is the production function,  $f(K,N)$ , defined on capital services associated with stock  $K$  and services associated with labor  $N$ .

$$\begin{aligned} X &= f(K, N) \\ \text{and } X &= K f_K + N f_N \end{aligned}$$

where  $f_K$  and  $f_N$  are partial derivatives. There is **not** marginal cost pricing of inputs because in (2.3),

$$pX \neq r q K + w N.$$

There is joint production of deposit services  $Q_d$  and loans  $Q_l$  in the bank. Inputs are the services of capital  $K^b$  and labor  $N^b$ . The production function is  $g(Q_l, Q_d, K^b, N^b) = 0$ . Thus we have, given constant returns to scale,

$$Q_l g_{Q_l} + Q_d g_{Q_d} = K^b g_{K^b} + N^b g_{N^b}.$$

Input prices fail to satisfy marginal cost pricing relations because of the risk terms in (3.3). In addition there are endowments  $K^*$  and  $N^*$  to the economy satisfying

$$\begin{aligned} K + K^b &= K^* \\ \text{and } N + N^b &= N^*. \end{aligned}$$

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